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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/705,251	11/12/2003	Takamitsu Higuchi	Q78440	3192

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EXAMINER	
DOUGHERTY, THOMAS M	

ART UNIT	PAPER NUMBER
2834	

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Please find below and/or attached an Office communication concerning this application or proceeding.

H·A

Office Action Summary	Application No.	Applicant(s)	
	10/705,251	HIGUCHI ET AL.	
	Examiner	Art Unit	
	Thomas M. Dougherty	2834	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *15 May 2006*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-83* is/are pending in the application.

4a) Of the above claim(s) *14-25,29-31,36-39,46-51,54 and 57-83* is/are withdrawn from consideration.

5)☒ Claim(s) *26 and 52* is/are allowed.

6)☒ Claim(s) *1-13,27,32-35,40-45,53,55 and 56* is/are rejected.

7)☐ Claim(s) *28* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *12 November 2003* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Response to Arguments

Applicant's arguments filed 5/15/06 have been fully considered but they are not persuasive. The contention that Iwashita et al. do not teach or suggest use of "an ion beam assist method" is disputed; Iwashita clearly states that his "upper electrode can be formed or grown by a laser ablation method ... with an ***ion beam assist***." This is clearly stated at page 8, paragraph [0125].

An additional search has been conducted and a reference has been found that relates to claims that have previously been indicated as allowable. Consequently this is not a final rejection.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1, 6, 8, 9, 12, 40 and 42-44 are rejected under 35 U.S.C. 102(b) as being clearly anticipated by Iwashita et al. (US 2002/0149019). Iwashita et al. show (fig. 5) a method for manufacturing a piezoelectric device, in which a bottom electrode (404) is formed on a substrate (401, 402, 403), a piezoelectric film (405) is formed on top of said bottom electrode (404) by an ion beam assist method, and a top electrode (406) is formed on top of said piezoelectric (404). See paragraph 0125.

Said piezoelectric film (404) is formed by PZT, BST or a relaxer material. See paragraph 051.

Iwashita et al. show a method for manufacturing a piezoelectric device in which a bottom electrode (404) is formed on a substrate (401, 402, 405) by an ion beam assist method, a piezoelectric film (405) is formed on top of said bottom electrode (404), and a top electrode (406) is formed on top of said piezoelectric layer (404). Again see paragraph 0125.

Said piezoelectric film (405) is formed on top of said bottom electrode (404) by epitaxial growth. See paragraph 0023.

Said bottom electrode (404) is formed by a conductive oxide material with a perovskite crystal structure. See paragraph 0125.

Iwashita et al. show (fig. 5) a method for manufacturing a ferroelectric device, in which a bottom electrode (404) is formed on a substrate (401, 402, 403), a ferroelectric film (405) is formed on top of said bottom electrode (404) by an ion beam assist method, and a top electrode (406) is formed on top of said piezoelectric (404). See paragraph use of PZT, $BaTiO_3$ et al. at paragraph 0051.

Iwashita et al. show a method for manufacturing a ferroelectric device in which a bottom electrode (404) is formed on a substrate (401, 402, 405) by an ion beam assist method, a ferroelectric film (405) is formed on top of said bottom electrode (404), and a top electrode (406) is formed on top of said ferroelectric film (404). Again see paragraph 0125.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 2-5 and 41 are rejected under 35 U.S.C. 103(a) as being unpatentable over Iwashita et al. (US 2002/0149019) in view of Sakamaki et al. (US 6,255,762). Given the invention of Iwashita et al. as noted above, they don't note using a sol coating that is subsequently dried, degreased and fired.

Sakamaki et al. show (fig. 1) A method for manufacturing a piezoelectric device (see ABSTRACT where inventors use ferroelectric and piezoelectric terms interchangeably), comprising the steps of: forming a bottom electrode (18) on a substrate (15); forming a piezoelectric film (17) on top of said bottom electrode (18) by performing a process in which a sol containing the material of the piezoelectric film is applied as a coating, dried and degreased to form a precursor, and (this precursor) is then fired, see col. 4, lines 48-53 for description of how this is the conventional practice; and forming a top electrode (16) on top of said piezoelectric film (17); wherein said precursor is irradiated with an ion beam at least once following said degreasing in said step of forming said piezoelectric film.

It would have been obvious to one having ordinary skill in the art to employ ion beam irradiation to the precursor following the degreasing step in the device of

Sakamaki et al., such as is shown by Iwashita et al. since this the device would have excellent piezoelectric properties as noted by Sakamaki et al. in their ABSTRACT.

Regarding repetition of the process of coating, drying, degreasing and irradiating, or irradiating after degreasing and before firing, or irradiating during firing, repetition of the process, to make a thicker layer for example, is obvious to one of ordinary skill in the art since mere duplication is what is occurring. Irradiation after degreasing but before firing or during firing, would be obvious to one of ordinary skill in the art since such would result in the desired result, and would simply enable one to achieve a desired result from known processes. Hence no real inventive step is performed.

Claims 11, 32-35, 55 and 56 are rejected under 35 U.S.C. 103(a) as being unpatentable over Iwashita et al. (US 2002/0149019) in view of Nakahata et al. (US 5,401,544). Given the invention of Iwashita et al. as noted above, they don't explicitly state use of a metal bottom electrode and they don't explicitly state that there is irradiation of the top surface of either the substrate or the lower electrode.

Nakahata et al. show (figs. 3A-3C) and note (col. 5, lines 11-25) forming a bottom electrode (4) on a substrate (1) forming a piezoelectric film (3) on top of said bottom electrode (4); wherein the surface on which said piezoelectric film (3) is to be formed is irradiated with an ion beam prior to formation of said piezoelectric film (3).

Nagahata et al. note their electrode is formed by a metal material (4). See col. 5, line 11.

Nakahata et al. show (figs. 3A-3C) and note (col. 4, lines 45-63) forming a bottom electrode (4) on a substrate (1) forming a piezoelectric film (3) on top of said bottom

electrode (4); wherein the surface on which said bottom electrode (4) is to be formed is irradiated with an ion beam prior to formation of said bottom electrode (4).

Nakahata et al. do not show a top electrode in their invention.

It would have been obvious to one having ordinary skill in the art to employ a metal electrode and to irradiate either the top surface of the substrate of Iwashita et al. or the top surface of the bottom electrode of the Iwashita et al., at the time of their invention, such as is taught by Nakahata et al., since this allows for precision in manufacture and high reliability as Nakahata et al. note at col. 3, lines 58 to col. 4, line 14.

Claims 7 and 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Iwashita et al. (US 2002/0149019) in view of Kashiwaya et al. (US 2003/0175062). Given the invention of Iwashita et al. they note there piezoelectric-ferroelectric film orientation in paragraph 0111 which is (001); as noted above, they don't note their compound composition including the specific requirements of claims 7 or 10.requirem.

Kashiwaya et al. show (fig. 1) a bottom electrode (26b) on a substrate (12C), a piezoelectric film (24) formed on top of said bottom electrode (26b) and a top electrode (26a) formed on top of said piezoelectric film (24)

Kashiwaya et al. further note (see ABSTRACT) use of a piezoelectric film containing a solid solution of PMNy-PZT1-y consisting of a relaxer material PMN comprising any of the compounds Pb(M1/3N2/3)03 (M = Mg, Zn, Co, Ni, Mn; N = Nb, Ta), Pb(M1/2NI/2)O3 (M = Sc,Fe, In, Yb, Ho, Lu; N = Nb, Ta), Pb(M1/2N1/2)O3 (M =

Mg, Cd, Mn, Co; N = W, Re) or Pb(M2/3N1/3)O3 (M = Mn, Fe; N = W, Re) or mixed phases of these compounds, and PbZrxTi-x)O3 (PZT, 0.0 <= x <= 1.0).

The specific orientation is not noted. They do not employ the ion beam assist method for formation of layers.

Regarding the specific orientation of the material, this is a result effective variable. It would have been obvious to one of ordinary skill in the art at the time the invention (of Kashiwaya et al.) to have any of the orientations of a cubic crystal (100), tetragonal crystal (001), rhombohedral crystal (100) or quasi-cubic crystal (100), since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. In re Boesch, 617 F.2d 272, 205, USPQ 215 (CCPA 1980).

It would have been obvious to one having ordinary skill in the art to use the material of Kashiwaya et al. in the device of Iwashita et al. at the time of his invention, since this material "hardly gives rise to dielectric breakdown or short circuit" as noted in the ABSTRACT."

Claims 13 and 45 are rejected under 35 U.S.C. 103(a) as being unpatentable over Iwashita et al. (US 2002/0149019). Given the invention of Iwashita et al. as noted above, they further note (see paragraph 0111) their said bottom electrode (404) as containing any of the compounds M2RuO4 (M = Ca, Sr, Ba), RE2NiO4 (RE = La, Ce, Pr, Nd, Pm, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu, Y), REBa2Cu3Ox (RE = La, Ce, Pr, Nd, Pm, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu, Y), MRuO3 (M = Ca, Sr, Ba), (RE,M)CrO3 (RE = La, Ce, Pr, Nd, Pm, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu, Y; M = Ca, Sr, Ba), (RE,M)MnO3 (RE = La, Ce, Pr, Nd, Pm, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm,

Yb, Lu, Y; M = Ca, Sr, Ba), (RE,M)CoO3 (RE = La, Ce, Pr, Nd, Pm, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu, Y; M = Ca, Sr, Ba), or RENiO3 (RE = La, Ce, Pr, Nd, Pm, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu, Y), or a solid solution containing these compounds.

They do not not that the electrode material is oriented in any of the orientations of a cubic crystal (100), tetragonal crystal (001), rhombohedral crystal (100) or quasi-cubic crystal (100).

It would have been obvious to one of ordinary skill in the art at the time the invention to have any of the orientations of a cubic crystal (100), tetragonal crystal (001), rhombohedral crystal (100) or quasi-cubic crystal (100), for the electrode compound orientation since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. In re Boesch, 617 F.2d 272, 205, USPQ 215 (CCPA 1980).

Claims 27 and 53 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hanabata (US 6,478,412) in view of Nakanishi et al. (US 6,229,250). Hanabata shows (fig. 1) forming a bottom electrode (2) on a substrate (5), forming a piezoelectric or ferroelectricfilm (3) on top of said bottom electrode (2); and forming a top electrode (4) on top of said piezoelectric film (3).

Hanabata does not note forming the bottom electrode by forming a first layer by an ion beam assist method, and forming a second layer by continuing deposition with the ion beam assist stopped.

Nakanishi et al. show (fig. 3) forming a piezoelectric film (claim 1); and forming a top electrode (24) on top of said piezoelectric film.

Nakanishi et al. teache forming an electrode by forming a first layer (24a) by an ion beam assist method (col. 4, lines 45-54), and forming a second layer (24b or 24c) by continuing deposition with the ion beam assist stopped.

Nakanishi et al. don't show a substrate and a bottom electrode.

It would have been obvious to one having ordinary skill in the art to form the invention of Hanabata by the method taught by Nakanishi et al. because this would allow for a device that does "not have the grain boundaries which serve as diffusion paths for the atoms" as noted at col. 1, lines 31-33.

Allowable Subject Matter

Claim 28 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Claims 26 and 52 are allowed.

The following is an examiner's statement of reasons for allowance: the prior art fails to show or fairly suggest a single layer of piezoelectric or ferroelectric material or an electrode in a device of those materials that is formed by ion beam assist followed by continuous deposition.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Direct inquiry to Examiner Dougherty at (571) 272-2022.

tmd

June 8, 2006

TOM DOUGHERTY
PRIMARY EXAMINER